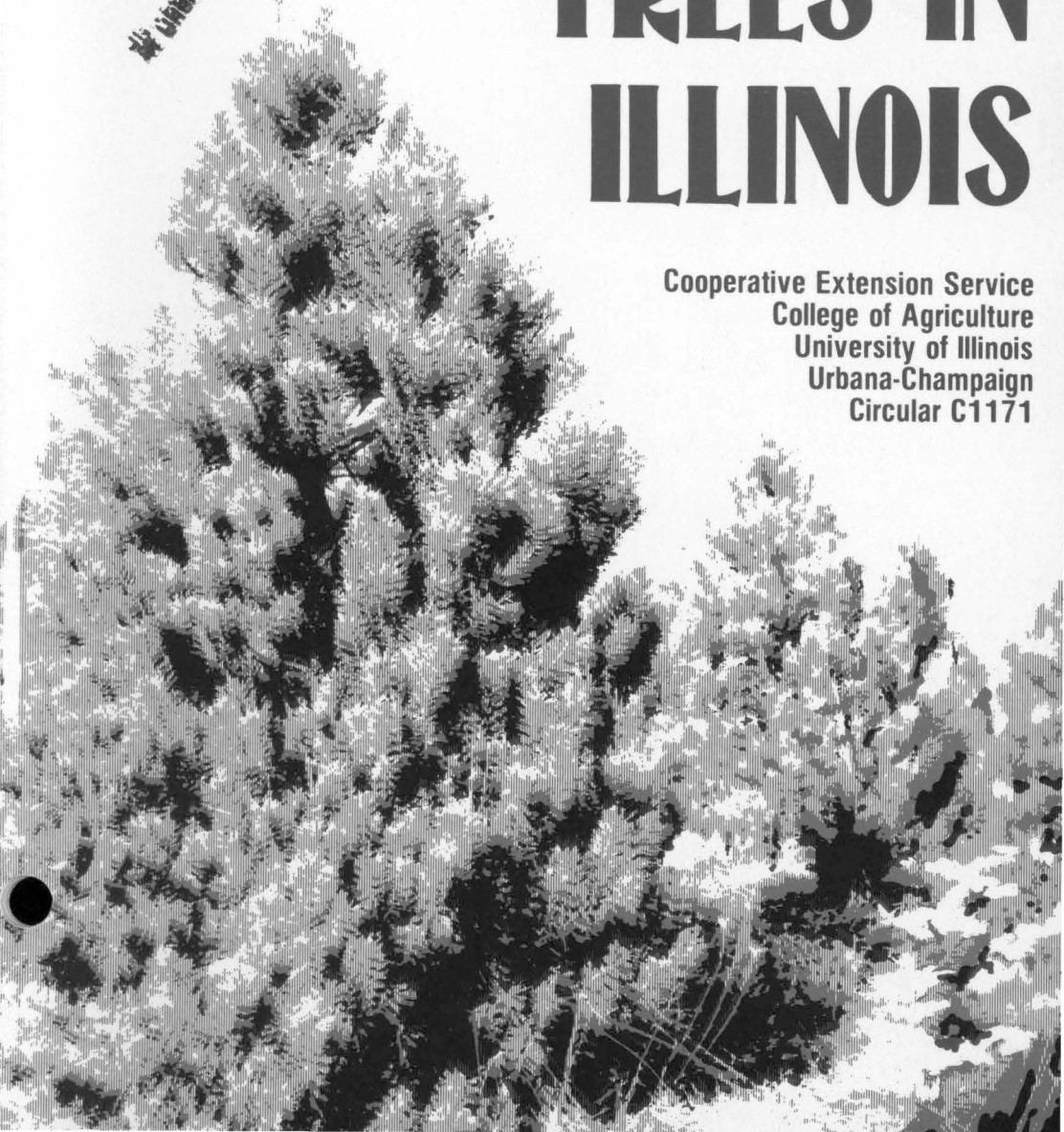
GROWING CHRISTMAS TREES IN ILLINOIS

Cooperative Extension Service
College of Agriculture
University of Illinois
Urbana-Champaign
Circular C1171



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THIS CIRCULAR is for persons who are interested in growing Christmas trees commercially. You will find information on selection of tree species, site selection and preparation, protection of the plantation, how and when to plant seedlings, cultural practices such as shearing, pruning, and fertilizing, and harvesting and marketing of the trees. An approximation of the costs and returns for the average Christmas tree enterprise in Illinois is given on pages 33-34.

If you decide to grow Christmas trees, your investment will be significant, and you must wait several years before you begin making a profit. Christmas trees usually cannot be harvested until the end of the seventh or eighth year after planting. Before investing in a business that must extend over an eight-year period, and that cannot be moved once the seedlings have been planted, you should choose a location that is

1. Large enough to include parking and storage areas, and possibly a retail lot;
2. Accessible to workers and machinery;
3. Close to your market;
4. Free of disease, insects, and fire hazards;
5. Protected against damage from wildlife;
6. Secure from vandals and thieves.

Detailed information on site selection, the single most important choice you will make as a grower, can be found on pages 5-9.

Tree Species

The favored species planted in Illinois for Christmas trees are Scotch pine and eastern white pine. Red pine and jack pine have been planted, but they are not easily managed and subsequently are less popular; Virginia pine shows promise in the extreme southern part of the state. These species generally do well on most sites in Illinois; they grow rapidly and respond to plantation culture.

A number of other Christmas tree species have also grown well and have been accepted by the public in certain areas of Illinois: Norway spruce, Colorado blue spruce, white spruce, Douglas fir, and Fraser fir.

Scotch pine (Fig. 1) is native to Europe and Asia. Several varieties are successfully grown and marketed throughout Illinois. In general, strains of Scotch pine originating from seed obtained from southern Europe have been more desirable than those from northern Europe, which tend to turn yellow in early winter. A number of nurseries have offered special strains

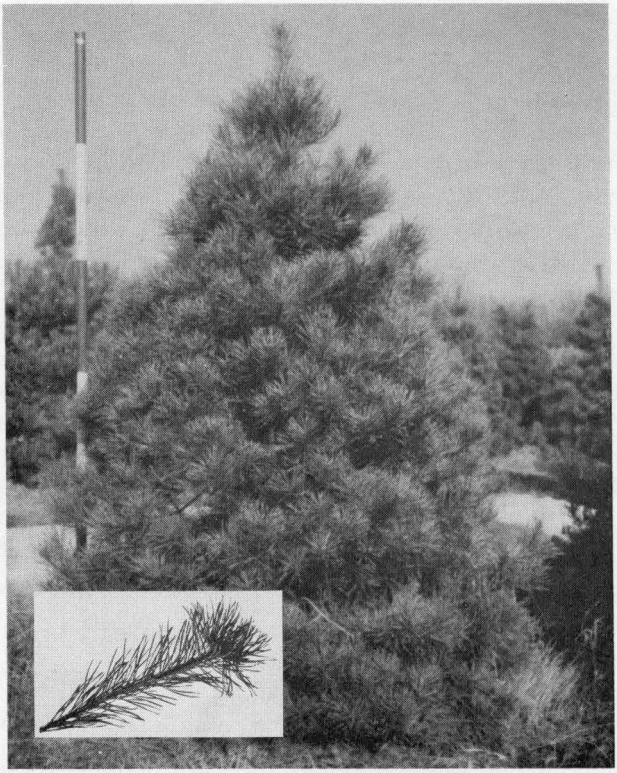

Figure 1. Scotch pine (*Pinus sylvestris*) is the most popular Christmas tree species in Illinois.

of Scotch pine. These special strains might be more desirable for Christmas trees than other stock because similar seed are collected each year. The needles of this tree are in fascicles of two; better varieties are blue-green, 1½ to 3 inches long, slightly twisted, and sharp pointed. The needles stay on the cut trees comparatively well. The branches are whorled and some varieties tend to develop a crooked stem. Scotch pine, which grows quickly, requires heavy pruning to develop a well-formed Christmas tree.

Eastern white pine (Fig. 2) is native to the extreme northern part of Illinois, but it grows well throughout the state. Because of the wide geographic range in which white pine grows, a number of desirable strains have been identified by Christmas tree growers. Because the supply of white pine seedlings from desirable geographical origins may vary from year to year, you should order the more desirable strains early. White pine has slender, flexible, bluish-green needles 2 to 5 inches long with five needles per fascicle; needle retention is good. Eastern white pine tree

Figure 2. White pine (*Pinus strobus*) is becoming popular as a Christmas tree species throughout Illinois.

grows rapidly and develops slender horizontal branches. It requires careful pruning for symmetry and the correct degree of compactness.

Virginia pine (Fig. 3) occurs naturally away from the Atlantic coastal plains from southern New York to northern Georgia and westward to northern Mississippi, with its range approximately bounded by the Ohio and Mississippi Rivers. The stiff needles are two per fascicle, about 2 inches long, yellow-green, and usually twisted. The foliage does not dry out rapidly and needle retention is good. Virginia pine is similar in appearance to Jack pine.

Colorado blue spruce (Fig. 4) is native to the Rocky Mountain region, but a limited number of trees are grown in northern Illinois. It is often used when a small Christmas tree is desired. Frequently the tree is dug, potted, and used indoors as a living Christmas tree, then planted outdoors as an ornamental. The needles are stiff, about 1 inch long, rather straight,

Figure 3. Virginia pine (*Pinus virginiana*) has possibilities as a Christmas tree species in southern Illinois. (Courtesy of Auburn University.)

blue-green to silvery green, and sharp-pointed. They extend at nearly right angles from all sides of the stout twig. Blue spruce has the best needle retention of all the spruces.

Douglas fir of southern Rocky Mountain origin is grown in limited quantities in northern Illinois where air drainage is good; otherwise it is subject to damage by late spring frosts. The needles of this tree are ¾ to 1¼ inches long, yellow-green or blue-green, soft and somewhat flattened, and they stand out from all sides of the twig. Douglas fir has excellent needle retention.

Red pine (Fig. 5) and **Norway spruce** were planted throughout Illinois in the past; but because of the poor needle retention characteristics of

Figure 4. Blue spruce (*Picea pungens*) is sometimes potted and used as a living Christmas tree.

Norway spruce and the difficulty of shearing red pine, planting of these species has declined in recent years. Red pine often is used when a large tree (15 to 20 feet tall) is desired. White spruce and Fraser fir are planted on a limited basis: white spruce suffers from needle drop, and both species grow slowly compared to the favored Scotch pine and white pine.

The successful grower selects species adapted to the region in which the business is located, and plants more than one tree species to satisfy differences in consumers' preferences and to help prevent loss from insects or disease.

Site

Site includes all the environmental factors, such as temperature, topography, air drainage, soil, and moisture availability, in which a Christmas tree is to be grown.

Figure 5. Red pine (*Pinus resinosa*) is difficult to shear.

Topography

Level to rolling land is best suited to Christmas tree production. The necessary cultural operations such as mowing, shaping, and harvesting are much easier if the land is not too steep or rugged. Furthermore, on steep areas it may be necessary to allow the trees to grow an additional year because the lower branches on the uphill side often develop poorly.

Wind Protection

The plantation area should be protected from excessive wind. Areas where the wind velocity is increased because of a funneling effect might break new leaders of the trees. Excessive wind also has a drying effect on the trees, and could kill those established on sandy areas. Excessive

winds could cause snow to build up on branches of thick-needled pine species, causing them to break.

Air and Water Drainage

Select areas where air drainage is good to avoid late spring frosts and freezes, which are very harmful to trees, especially Douglas fir and the spruces. Good surface and internal soil drainage is necessary for successful growth of all Christmas tree species and for the operation of mechanical equipment.

Soils

Soil for growing Christmas trees should be neither too poor nor too fertile. Trees growing on poor soils usually have poor form, growth, and color, whereas trees established on very fertile soil grow too fast and require heavy pruning. Weeds and grass are likely to compete with the tree stand on very fertile soils. The ideal soil is slightly acidic, deep, relatively easy to work, and with an open texture that results in good internal drainage. If possible, avoid coarse sands, heavy clays with restrictive clay pans, or swampy areas.

Preparing the Site

Areas that formerly were pasture or planted to row crops are desirable for Christmas tree plantations. Such areas are easier and more economical to prepare for planting trees than those that require the clearing of cull trees or brush. Vines, hardwood sprouts, and briers that remain on cleared land may interfere with the planting. Stumps on cutover land also interfere with mowing, planting, and other cultural operations.

Some land may require grading to fill small gullies, construct a road system, or modify the surface drainage. The Soil Conservation Service, U.S. Department of Agriculture, is a good source for advice on grading and drainage.

Vegetation on lands that are to be planted to Christmas trees can be controlled by various methods, depending upon the severity of the unwanted vegetation. As a general rule, when woody growth covers more than one-third of the area and the cover is over eight feet in height, bulldozing gives the best results.

If the area is mainly a heavy grass sod, grass and roots can be removed by scalping either with hand tools or with mechanical equipment. When scalping with a mattock, you must remove both the grass foliage and roots in an 18-inch square area where the seedling is to be planted. A fire plow or scalpers on a planting machine will scalp parallel bands two feet wide.

Some field may require mowing in late fall or early spring, followed by a herbicide application in bands over rows to be planted. If an area has been in clean cultivation the previous year, discing in the fall might be sufficient for spring planting.

If the areas are covered by low brush or scattered large trees, herbicides are an effective method of preparing the area for planting. Where the brush is less than eight feet in height, foliage spraying is normally the best method (Fig. 6). A few trees larger than four inches in diameter scattered over the area are satisfactorily controlled by frilling followed by applying a herbicide in the frill (Fig. 7). Several kinds of tree injectors are commercially available that accomplish the same results. The injector is driven into the base of the tree at one-inch intervals and a predetermined amount of herbicide is released into each incision.

Chemicals can be used effectively before or during planting to remove grass and broadleaf herbs which could offer cover for insects and rodents;

Figure 6. Spraying foliage with herbicides effectively kills brush.

you will have better tree survival and height growth the first year. Chemically treated areas can be circular spots one to two feet in diameter, spaced at the desired planting spacing, or parallel strips one and one-half to two feet wide; the trees can be planted in the center of each sprayed circular spot (Fig. 8) or at the desired spacing in the sprayed strip. Consult your extension adviser for specific chemical recommendations.

Planting

Plantation Layout

Before the first tree is planted, the entire area should be laid out for efficient operation. Such items as location of roadways, lanes, and grassways suitable for vehicle travel, row spacing and tree spacing within the row, and direction of rows should be considered carefully. Decisions reached on area layout will affect future planting and harvesting operations, fire protection, and the movement of vehicles throughout the plantation. It will be difficult to change the layout before most of the trees are harvested (Fig. 9).

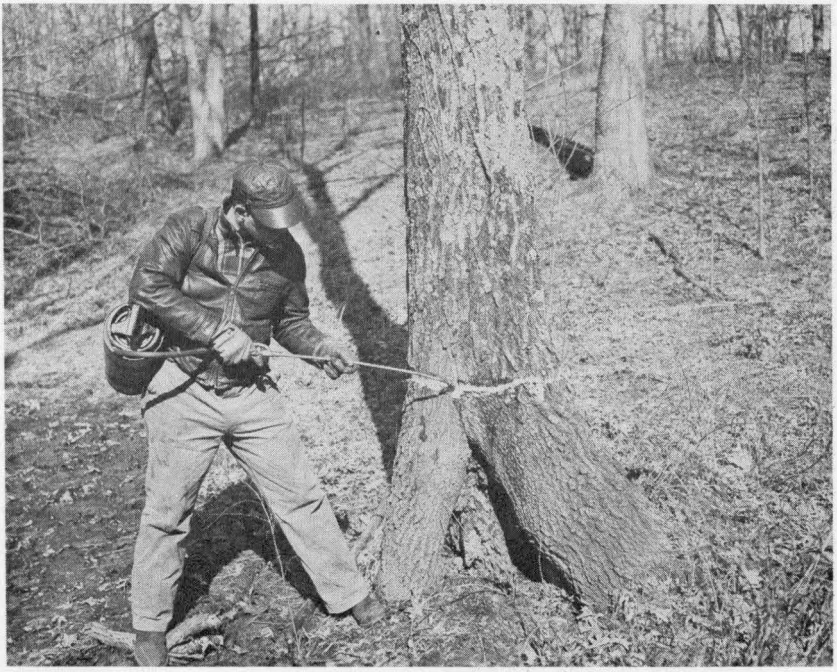

Figure 7. Large trees can be killed by applying a herbicide in the frill.

In laying out the plantation, you should divide the major planting units into smaller blocks for better accessibility. All areas of the plantation should be readily accessible to vehicle travel during all seasons. Lanes or roadways separating the major blocks should be spaced not over 200 feet apart; they should have an initial width of 15 feet because limb growth will reduce this space to around seven feet. When there is any appreciable degree of slope, roadways should be located along the contours.

Row spacing and tree spacing depend not only on the species of tree, but also on the individual Christmas tree farm and its equipment. Spacing will be dictated by the mowing machinery and the topography of the area.

Figure 8. A pine seedling planted in a chemically treated area. (Courtesy of Mississippi State University.)

Figure 9. The plantation should be laid out for efficient operation.

Most growers use a 6- x 5-ft. (1,410 trees per acre) or a 6- x 6-ft. (1,210 trees per acre) spacing to utilize land area efficiently. If a market exists for small trees, a closer spacing (4 x 4 ft., 2,722 trees per acre) can be used. Square or diamond spacings should be established if mowing is to be done in both directions. If herbicides are used in conjunction with mowing, spacings between trees in a row need not be exactly the same as between rows because mowing will be done only between rows.

Direction of rows should be determined by the shape or topography of the field. Usually, rows on the contour will permit easier mowing and movement along the row. When the topography is gently rolling, you may want to run the rows up and down the slope to take advantage of longer rows.

Planting Stock

A successful Christmas tree plantation begins with quality seedlings. Good seedlings have a well-developed fibrous root system, a sturdy stem, and balance between the top and root system. The seedlings should be neither too tall nor too short: 6 to 10 inches is about right. Trees smaller than 6 inches are difficult to plant, and their survival and growth rate is likely to be low. Growers should cull the small, spindly seedlings, those of poor form and vigor, and those with a weak bud.

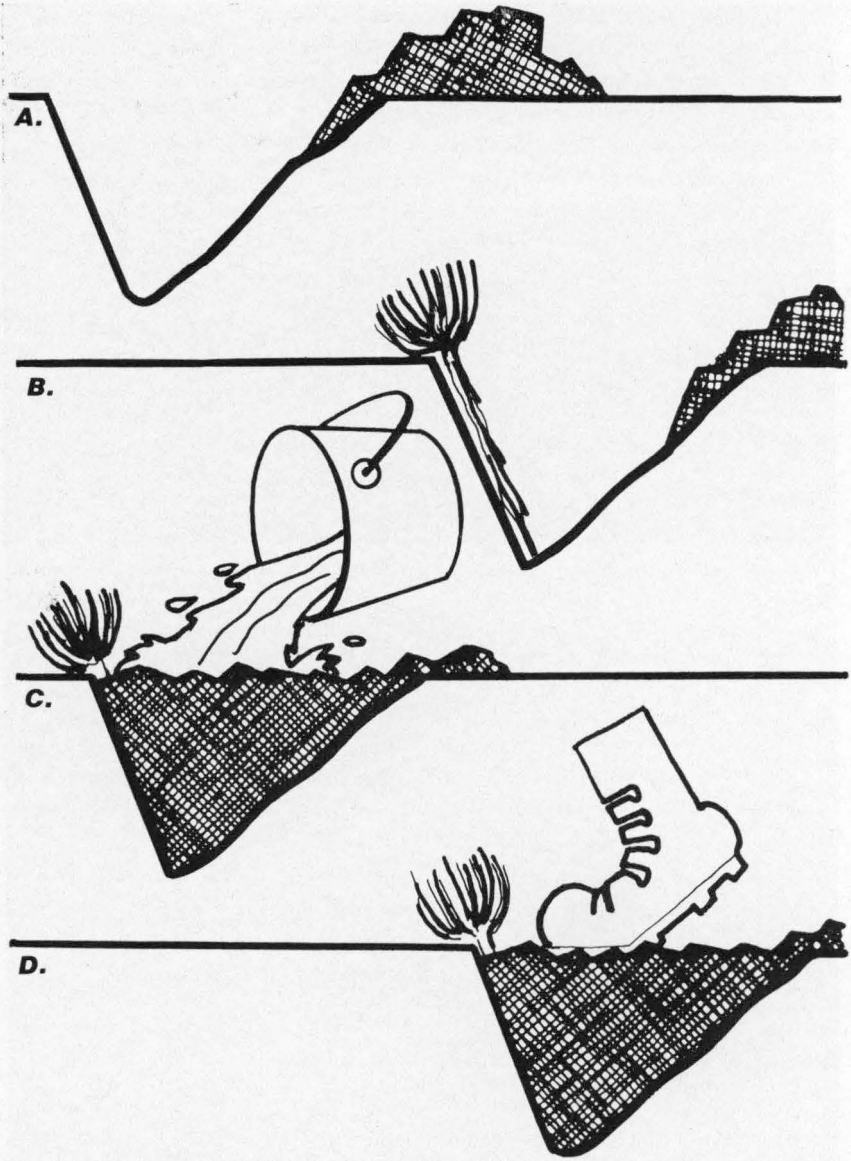

Figure 10. Methods of heeling-in planting stock: *A.* Dig a V-shaped trench that is deep enough to accomodate roots in moist, well-drained soil; ***B.*** Break the bundles of seedlings and spread seedlings out evenly against one side of the trench; ***C.*** Fill the trench with loose soil and water well; ***D.*** Complete filling in the trench and firm the soil.

Planting stock can be purchased from either state or commercial nurseries. The Illinois Division of Forestry nurseries produce seedlings primarily for reforestation purposes and do not always have the species best suited for Christmas trees. Contact the Division in Springfield or the Cooperative Extension Service in your county for information about obtaining trees from the state nurseries. Commercial nurseries normally use seed from the best varieties and strains of the species suitable for Christmas trees. For information on commercial tree nurseries that produce Christmas tree planting stock, contact your county extension adviser or State Service Forester or the Extension Forester, University of Illinois, Urbana.

Planting the Seedlings

The best time to plant seedlings is in the spring before tree growth has started. In the extreme southern section of the state, some growers plant in the late fall or early winter, but frost heaving makes this operation somewhat hazardous. Replacement planting should follow the above plan.

Nurseries may lift seedlings from nursery beds in late fall or early spring. The fall-lifted stock usually is held in cold storage until the following spring when it is bundled for shipment to the growers. When seedlings are received, the tree roots should be wetted and the bundle stored in a shaded, cool place, out of the wind, where freezing can be prevented. If the seedlings cannot be planted within a week, they should be temporarily stored or "heeled in," that is, roots covered in a V-shaped trench in a well-drained, shady spot (Fig. 10); or the bundles could be temporarily stored in a cold room with temperatures between 33° and 38° F.

During planting, keep the seedlings in a bucket with the roots covered with water. Roots must not be allowed to dry, even for a short time. Trees can be planted either by hand or by machine. Both methods give good results. The method to use will be dictated by the size of the area to be planted, conditions of the planting site, availability of labor for hand planting, and availability of a planting machine and tractor. Regardless of the method used, plant the seedlings at about the same depth (but never shallower) than that at which they were grown in the nursery. Be sure to plant them so that the main roots are straight down, not doubled or sharply bent. It is better to cut off the tips of the longer roots than to have them doubled up.

The best hand tool to use in planting young seedlings is a planting bar (Fig. 11), which makes a vertical slit in the ground. The tree roots are put into the slit, which is then closed both at the bottom and top. This is one of the fastest hand-planting methods when soil conditions are ideal: an individual can plant about 600 seedlings per day. Planting bars are available from several manufacturers or equipment suppliers whose names

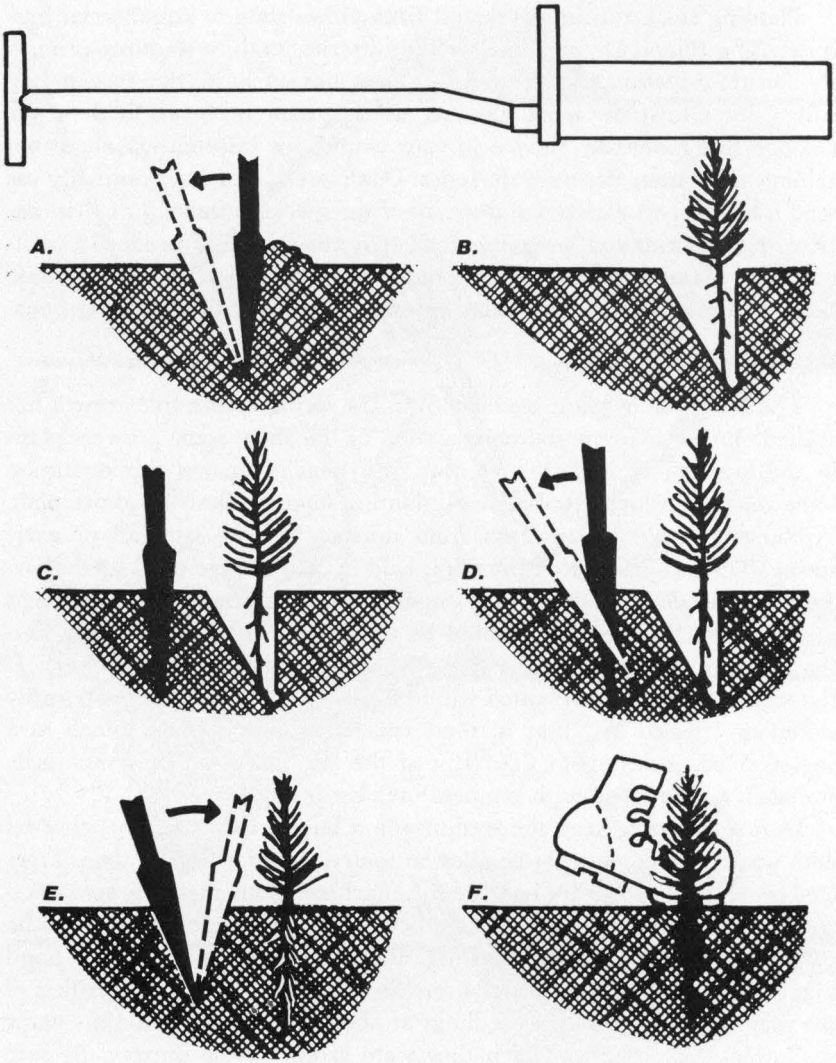

Figure 11. Planting seedlings with a planting bar: ***A.*** Insert the planting bar as shown and pull it towards you; ***B.*** Remove the planting bar and place the seedling at the correct depth; ***C.*** Insert the planting bar 2 inches away from the seedling; ***D.*** Pull the handle of the planting bar towards you, firming the soil at the bottom of the roots; ***E.*** Push the handle of the planting bar away from you, firming the soil at the top of the roots; ***F.*** Firm the soil around the seedling with your feet.

Figure 12. For planting large acreages, a tree-planting machine is more efficient than planting by hand.

and addresses can be supplied by the State Division of Forestry. A planting bar also may be made in a local shop.

Another hand-planting method called the "hole method," which consists of planting seedlings in a hole dug with a mattock, works well on rough land and for seedlings with large, spreading root systems.

If you are planning to plant a large number of seedlings, you should investigate the possibility of using a tree-planting machine (Fig. 12). Two persons using a machine can plant 8,000 to 10,000 seedlings in an 8-hour day. Results show that both survival and growth of machine-planted seedlings are comparable to that of hand-planted seedlings. Contact the State Division of Forestry for information concerning the availability of a machine in your area.

If only a small amount of land is available, the entire area might be planted at one time. If this procedure is followed, the grower should plan to plant another tree soon after one is harvested. This procedure eventually results in an all-age rotation system.

On larger land areas, the grower might wish to plant part of the area and harvest this portion at one time. This method is usually called an even-age rotation. With this rotational system, the grower must estimate in advance the amount of land needed to produce the number of trees he expects to harvest each year. Only one-seventh to one-eighth of the area

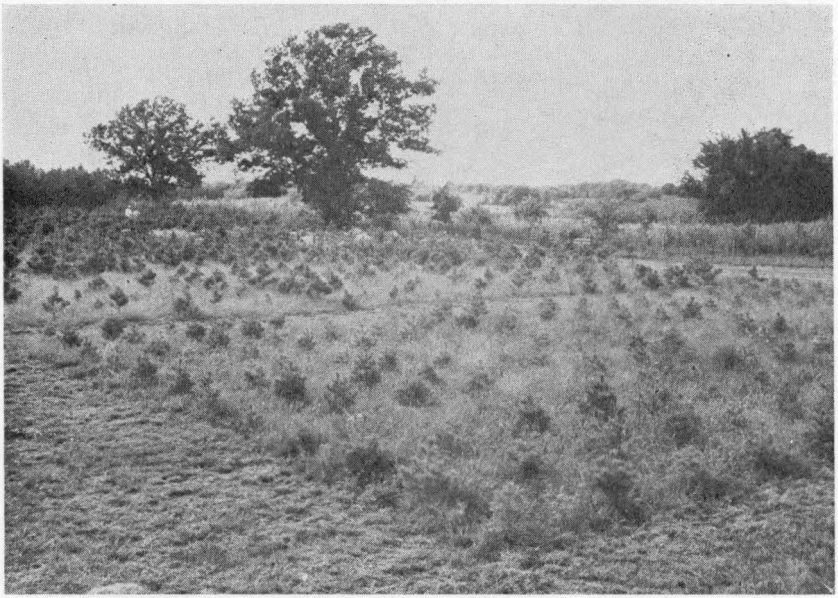

Figure 13. Areas between blocks of trees should be kept open.

Figure 14. A small mower is adequate for a small business.

should be planted the first year. An area of similar size is planted each succeeding year until the entire area is planted. After the first planted trees are harvested, the area is replanted and the rotation is repeated. An important consideration in determining the number of trees to be planted each year is the amount of time required each year to perform cultural work such as pruning and shearing.

Pines have relatively low fertility requirements and do not require fertilization on most sites. On sites where moisture conditions are favorable but fertility is low, the more exacting species such as spruces, firs, and Douglas fir can benefit from fertilization. On these sites, slow-release fertilizers usually give best results. These fertilizers can be placed in holes *adjacent to* but *separate from* the root system, or placed in special packets that can be placed in the planting holes themselves. Seedlings can be injured or killed if soluble fertilizers are placed so that they can come in contact with root systems. Applying fertilizers without adequate weed control can stimulate excessive competition from herbaceous vegetation, thereby reducing tree survival and growth.

Survival rate of planted seedlings is determined in the fall and spring following the first growing season in the field. If mortality of seedlings is low, the dead seedlings are normally not replaced if the plantation is operated as an even-age rotation. If a large number of the seedlings have died during the first growing season, or if the grower is operating an all-age rotation system, lost seedlings should be replanted. Replacement seedlings should be large, healthy stock with good root systems. You might keep a supply of replacement seedlings in a nursery bed to be used. The use of larger seedlings helps to keep the rotation age of the replacements in line with that of the trees originally planted. More care must be taken in planting larger seedlings to insure survival, including the scalping or removal of grasses and weeds from the planting spot.

Protection

Once seedlings are planted, the task of growing quality Christmas trees depends upon several protective measures.

Fire

Fire can completely destroy a Christmas tree planting. Young trees are killed by fire; older trees, if not killed, are left unmarketable. Because no location is entirely safe from fire, fire precautions should always be taken.

Trees near highways are more likely to be destroyed by fire than those at a distance from main roads. Trees should be planted in blocks between which a system of access roads and fire lanes can be maintained (Fig. 13). These roads and lanes should be cleared each year to keep them open.

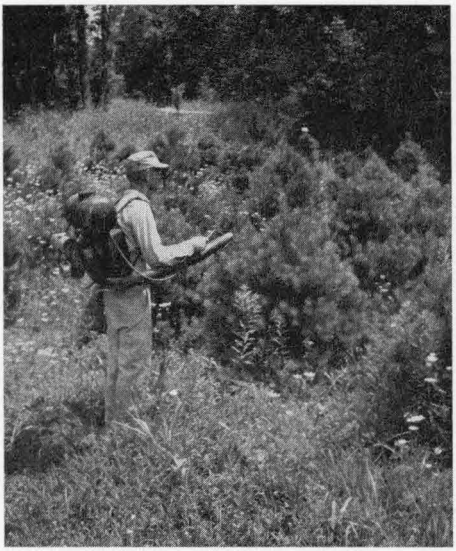

Figure 15. A motorized backpack sprayer will cover a sizeable area. (Courtesy of *Christmas Trees.*)

The grower should have fire tools available and be ready to suppress any fire. You should know the location of the nearest forest warden and other help so that a fire could be reported immediately.

Animals

Christmas tree plantations should be protected from livestock and other animals. Livestock stunt and deform trees by trampling, browsing, and brushing against them. Animals also compact the soil, causing slower growth and deformed trees. A fence constructed around plantations helps prevent domestic animals from entering but does not restrict wild animals.

Deer will browse most pines and firs, rabbits and groundhogs nip or girdle trees, and mice and gophers may cause much damage. Hunting and trapping can reduce deer, rabbit, and groundhog damage. Control of heavy grass and weed growth usually reduces the mouse population. If necessary, mice and gophers can be controlled with poison bait. If damage by wild animals becomes excessive, consult your local game officials.

Weeds

Grass and weed competition may be controlled by mowing alone (Fig. 14) or by a combination of mowing and chemicals. Frequent mowing between rows of seedlings eliminates much of the weed problem and reduces the need for extensive hand-cutting or chemical weed control. Mowing helps remove shrubs and tree seedlings; many plants eventually succumb as a dense grass sod develops between the rows.

Some growers use chemicals for weed control almost entirely. Keeping dense grass away from seedlings during the first three years enables the lower branches to develop normally, and scarcity of weeds reduces the danger of girdling by mice. Herbicides usually are applied in a liquid form but granular products are also available. Chemicals can be either band, broadcast, or spot applied. Availability of labor and topography of the area might dictate the use of chemicals for weed control. Consult your county extension adviser for the best chemical to use in your plantations.

Insects

Prompt identification and control of destructive insects is a must for producing Christmas trees. Even minor foliage damage by insects demands corrective action, but there is no need to follow a specified spray schedule that involves several spray treatments each year; simply use a spray treatment only when required (Fig. 15). A few of the more common Christmas tree insects are covered briefly in the following comments. Your county extension adviser should be consulted for more details.

Insects can be divided into three groups: (1) those that attack foliage, (2) those that chew on stems, and (3) those that destroy roots. The first group is represented by sawflies, webworms, bagworms, red spiders, and spruce mites. The sawfly larvae (caterpillars, Fig. 16) can cause serious reduction of foliage density; they can almost strip smaller trees in a matter of days. These larvae often occur in large concentrations and require immediate control. The sawfly attack mainly pines but also may be found on spruce.

Pine webworms often damage seedlings, causing partial defoliation and reduced vigor. The larvae feed on needles and form a web containing brown pellets around the stems of small seedlings.

Bagworm larvae build a bag or sacklike covering that is composed of leaves or twigs fastened together with silk. Heavy infestations result in serious defoliation.

Trees affected by red spiders and spruce mites often turn pale yellow with the needles sticky and covered by a silken webbing. Mites are most prevalent in hot weather, causing severe damage during periods of drought.

Insects that severely damage the tree stem are pales weevils, pine shoots or tip moths, pine bark aphids, spittlebugs, and mound-building ants.

The dark reddish-brown adult pales weevils (Fig. 17) feed at night chewing on the bark of young trees, which can result in girdling and death. Gradually declining trees and the presence of blackened bark at the soil line are indicators of this insect. Quite often seedlings and even larger trees are fatally injured before symptoms appear.

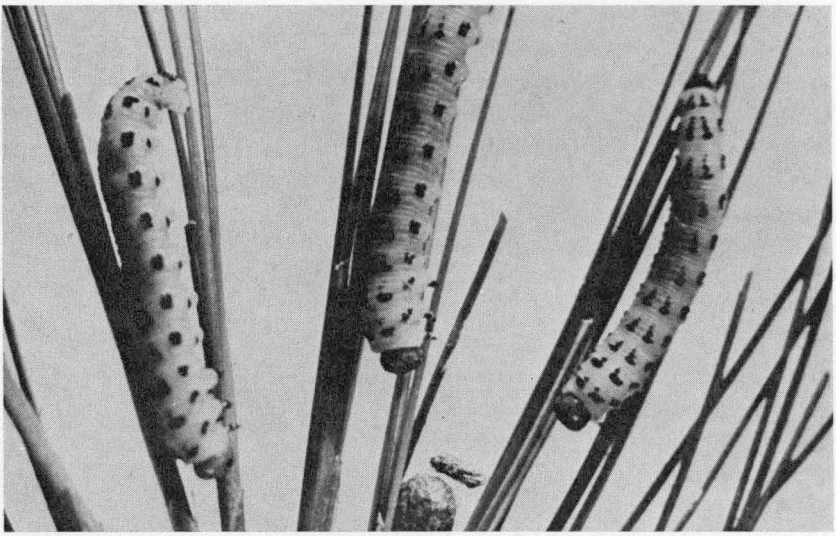

Figure 16. Sawfly larvae can defoliate a pine tree in a few days. (Courtesy of the Illinois Natural History Survey.)

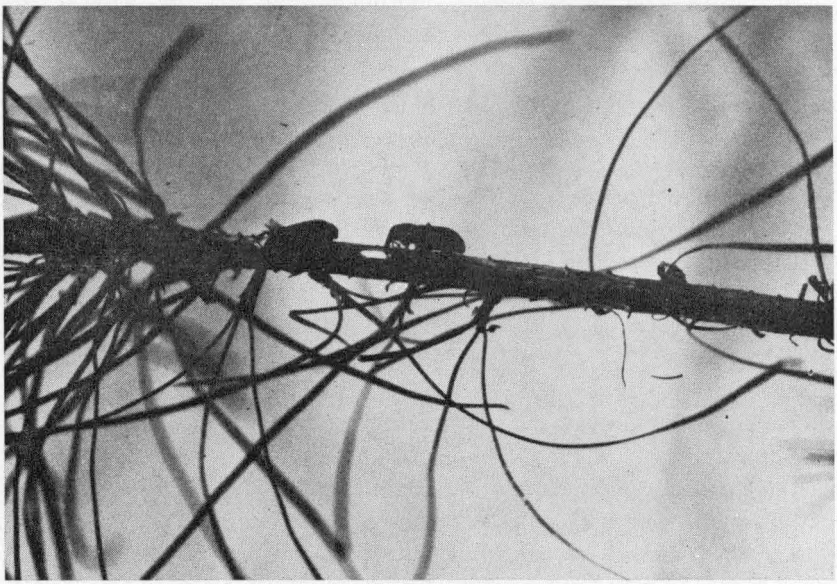

Figure 17. Pales weevils girdle stems of young seedlings. (Courtesy of the U.S. Forest Service.)

Pine shoots or tip moths attack most pine (Fig. 18). Adult rust-colored moths emerge during late spring and deposit their eggs near the top of the shoots on either the shoot or needles. The larvae bore into the needles and buds, leaving a spot of pitch at the bud base. The resultant crooking, curling, and bushiness can render the tree unmarketable.

Pine bark aphids may be recognized by the white cottony material that covers their bodies and collects in patches wherever they are present. They usually feed on the underside of limbs and on the trunk, sucking sap through the bark. Usually these insects will not kill the tree but they are unsightly and make the tree unsalable.

Pine spittlebugs feed on the needles and young bark of all pines. The nymphs form a spittle mass and live in it while sucking sap from the twig or needle. Unless spittlebugs are present on trees already cut to be marketed, they often can be ignored because they cause only slight damage.

Figure 18. Pine shoot moth larvae in a young leader. (Courtesy of Mississippi State University.)

Figure 19. Needle cast of pine results in an unsalable tree. (Courtesy of *Christmas Trees.*)

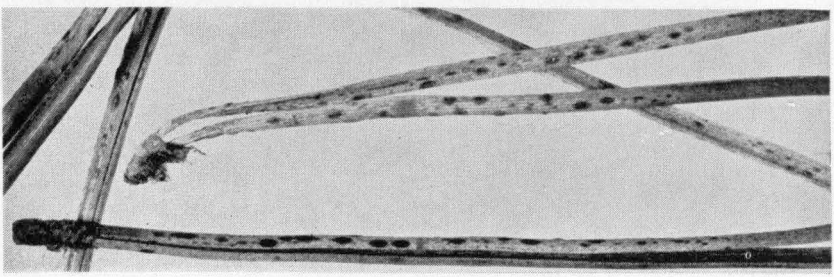

Figure 20. Fruiting bodies attached to pine needles affected with needle rust disease.

Mound-building ants are sometimes found in young Christmas tree plantations. They often build their mound next to a tree and kill the young trees in the immediate vicinity of the mound. A number of chemicals have controlled these insects.

White grubs are troublesome in new plantings in old sod fields because they eat the roots of newly planted trees. The planting area should be closely examined for this insect and corrective measures taken before trees are planted.

Diseases

Diseases of Christmas trees may be classified as either infectious or noninfectious. The infectious diseases are transmitted from one tree to another, whereas the noninfectious are not.

The primary infectious diseases of Christmas trees are those caused by fungi. A typical example is needlecast (Fig. 19), which is responsible for defoliation of pines, spruces, and firs. Although some trees are killed, the primary damage is the premature needlecast, rendering the tree unmarketable as a Christmas tree. The trees should be sprayed with a fungicide when symptoms first appear in the plantation.

Needle rusts (Fig. 20) are also infectious. These diseases are most prevalent on young trees, but in certain situations older needles are killed, resulting in slowing of growth and unsightly foliage. Goldenrod and aster are alternate hosts of these diseases: cultivation or mowing removes the immediate source of innoculum and keeps the incidence of these diseases at a minimum.

Brown spot diseases on red pine and Scotch pine can become a serious problem in some locations. These diseases can be controlled with fungicides if detected early and losses can be held to a minimum.

Drought stress is one of the more serious noninfectious diseases of Christmas trees. This condition is usually associated with inadequate soil moisture during extended periods of abnormally low rainfall. Drought symptoms are produced when loss of water through the needles exceeds uptake of water by the roots. Symptoms include wilting, discolored foliage, and a general decline in vigor that may eventually kill the tree. Crowns of drought-stricken trees usually die from the tops down. Trees in this condition are readily attacked by fungi and insects.

Needle droop, a noninfectious disease associated with drought, occurs primarily on red pine as a result of sudden, rapid transpiration when the soil is dry. The needles around succulent tissue droop and die, but the buds usually remain alive and develop normally the following spring.

Another disease associated with drought is heat camber, which occurs on young seedlings when the soil surface becomes hot enough to kill tissue

cells. A symptom of this disease is swelling of the stem above the injured tissue.

Cold weather injury to Christmas trees can take a number of forms. An early fall or late spring frost, when trees are actively growing, can injure or kill succulent stem tissue and buds. Most trees can survive frost injury, but their growth rate will be reduced. Breakage by ice and snow can cause considerable damage to a Christmas tree plantation. Even if the trees or limbs are not broken, the trees may be bent so that their value is reduced. If these conditions appear a few years preceding harvest, corrective pruning could help salvage most of the trees. Winter burn and winter drying are common winter injuries. Winter burn causes a browning of needles during rapid temperature changes, particularly on the south side of trees where there is more exposure to the sun. Winter drying is caused by the desiccation of foliage and twigs by warm dry winds when water conduction is restricted by the freezing of plant tissues or by frozen ground. Reddening, browning, and in some cases drooping of foliage becomes apparent in late winter and early spring.

Chemical injury to Christmas trees can be divided into herbicide injury and air pollution injury. Improperly applied herbicides can cause needles to turn yellow or brown and succulent shoots to curl or become deformed. Trees usually survive, but their growth is slowed.

Chemical pollutants emitted into the air from various manufacturing plants, automobiles, and heating plants can injure trees under certain conditions. These toxic compounds form in the atmosphere and can injure vegetation miles away from the source; it is not always possible to determine their exact origin. White pine is the Christmas tree most sensitive to air pollution.

Cultural Practices

Shaping

Shaping Christmas trees is the most important cultural practice in producing salable trees. Figure 21 is a drawing of a typical Christmas tree with the individual parts labeled. You must know the name of each part of the tree if you expect to communicate with your workers and other growers. Shaping can be divided into shearing and pruning. Shearing refers to the light clipping of limbs near their ends to achieve a conical shape with the correct taper and desired density. Pruning refers to the removal of multiple terminals and double stems, and cutting of the terminal at the correct angle (Fig. 22) to insure a single vertical stem.

After an initial establishment period of one to three years, planted seedlings grow so rapidly that long internodes give trees an open and irregular look. Unless the trees are shaped, only about 15 percent will be

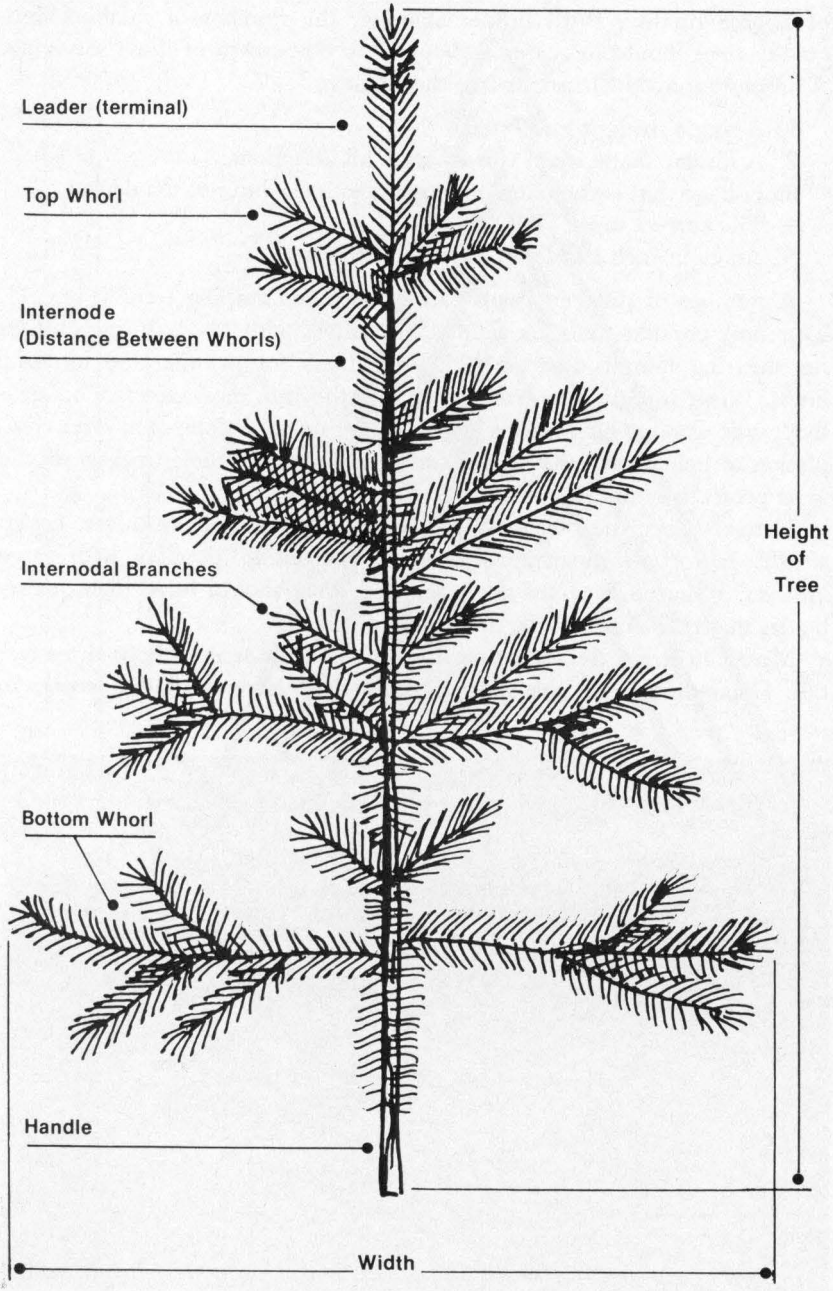

Figure 21. Common terms for parts of a Christmas tree.

of salable quality. With proper shaping, the number of salable, high-quality trees should increase to about 70 to 80 percent of those surviving. A properly shaped Christmas tree should have

1. A single straight main stem;
2. A similar shape when viewed from all directions;
3. Foliage that is compact (no large openings) but not too dense;
4. The correct taper (Fig. 23);
5. An eight-inch handle at the base of the tree.

A number of different tools can be used for shaping trees (Fig. 24). The most popular tools are lightweight knives with 14- to 16-inch blades for shearing laterals and small hand-pruners for pruning the terminal limbs. When using knives, remember that they are most effective on relatively soft wood, which means that shearing must be done soon after completion of height growth. Knives can be a dangerous tool; workers should wear protective hand, leg, knee, and thigh guards.

Hedge shears, used by some growers, are not as fast as knives. Lightweight motorized shearing devices are becoming popular with large growers. Regardless of the tools selected, they should have high-quality blades that stay sharp with a minimum of care.

Most Christmas trees are first shaped when the tree is about three feet tall. Depending upon the species, this height is reached the second to

Figure 22. The terminal should be cut at a 45° angle.

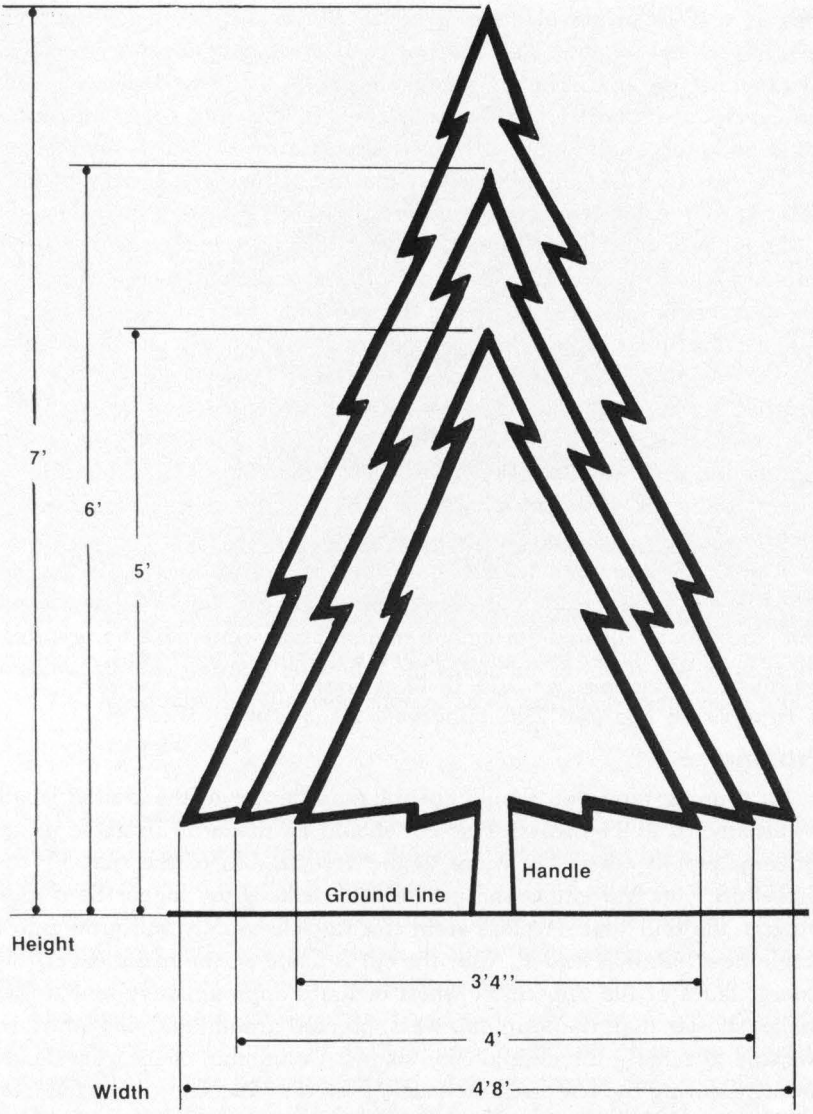

Figure 23. Desirable tapers for 5-, 6-, and 7-foot trees, with the width two thirds of the height. For example, a 7-foot tree should have a width of 4 feet 8 inches.

fourth year following planting when the terminal growth for that year exceeds 10 to 12 inches. The first few years of shaping are concerned with establishing the tree skeleton, which consists of the central stem and successive branch whorls. The desirable tree skeleton has a straight central stem with the lower series of branch whorls at 6- to 8-inch intervals up to the first four feet of tree height; spacing of the branch whorls in the top portion of the tree increases progressively to 10- and 12-inch intervals.

Pruning or shearing of pines should be done once in the spring or early summer when the new growth is still soft and succulent. You may need to shear Virginia pine twice during the growing season to produce high-quality Christmas trees. One method to determine whether height and lateral growth has slowed or stopped is to observe the needles on the new growth. If the needles lie close to the stem, growth is still active. When the needles start to stand away from the stem, all enlargement is near completion and there will be no further lengthening of the terminal or lateral branches. Shearing pines too early will result in few buds, slow growth, and dead stubs. If the trees are sheared too late, the new buds will be small, sparse, or absent. Late shearing results vary somewhat for the different pine species and the degree of lateness. Limbs of Scotch and red pines can be sheared during late summer, fall, winter, and early spring; some buds will form on cut stems the following growing season. Limbs of white pine sheared during these seasons normally will die back.

Pruning

In pruning pine, you should cut the main leader to the desired length — usually 10 to 14 inches. This cut should be made at an angle of approximately 45 degrees or more to the verticle axis of the tree. By this procedure you will cause one needle fascicle to grow higher than most others: the bud that develops from this fascicle usually will grow into a single new terminal leader. After the cut is made on the main leader, clip lateral limbs of the uppermost whorl of limbs approximately four to five inches shorter than the terminal. Next, proceed around and downward on the tree to achieve the desired cone shape. A minimum of shearing should be done during the season immediately preceding harvest so that the trees will have a natural appearance. A desirable tree is two-thirds as wide at the base as it is tall, and has medium density. The tree needs a handle of approximately one inch for each foot of tree height, plus a little allowance for a fresh cut when the tree is fastened into its holder. Often you need to remove at least the lower whorl of branches, which is best accomplished during an early shaping operation.

A single-needle conifer, such as spruces, firs, and Douglas fir, produces a terminal stem and a major whorl of lateral limbs each year. A number

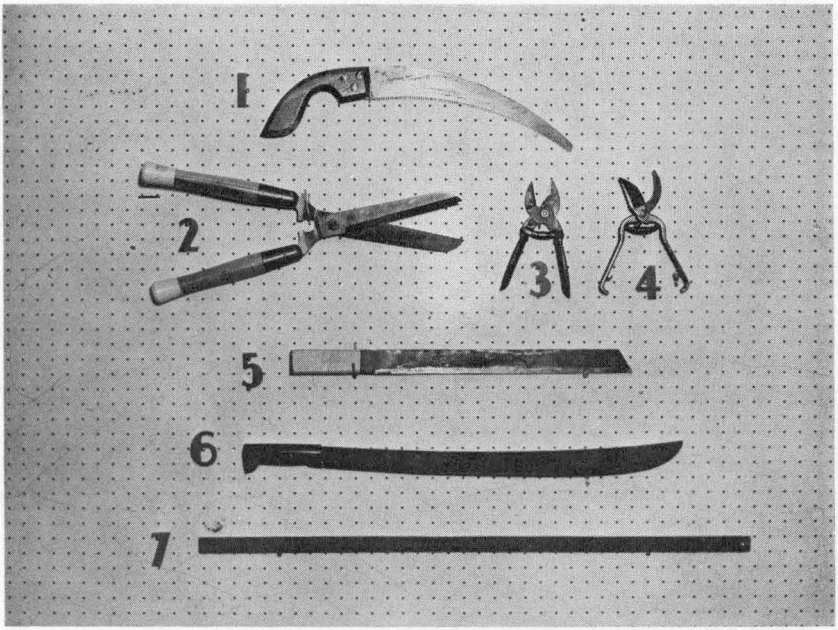

Figure 24. Tools used for shearing and shaping Christmas trees: (1) pruning saw; (2) hedge clippers; (3-4) pruning clippers; (5) shearing knife; (6) machete; (7) measuring stick that can be used as a straight edge.

of buds located along stems between each whorl develop into small limbs. Needles are borne singly along the twigs and no dormant buds are located at the base of these needles. Consequently, buds and limbs do not increase after pruning as they do on pines. Pruning only stimulates existing buds to grow into stronger limbs and these, in turn, help cover open areas and give the trees a more uniformly dense appearance.

The single-needle conifers can be pruned any time of year without causing serious problems such as those associated with off-season pruning of pines. But if these trees are sheared while shoots are growing, they may have additional stem growth which may require additional shaping to give the tree an even, conical shape. Therefore, it would be to your advantage to shape single-needle conifers after the shoots have stopped growing.

In shaping the single-needle conifers, the terminal leader should be cut 10 to 14 inches long at a point approximately one-half inch above a single, large, vigorous side bud. After the terminal is cut, prune the lateral branches to give the desired cone shape to the tree.

Tree Color

Trees may be sprayed in the field with green colorant in early fall to mask the natural yellowing that occurs on some trees. Spraying costs relatively little and is good insurance against having unsalable yellow trees. The colorants are dyes that do not harm the living tree. Some consumers may object to the artificial color, but most demand it. There will always be enough harvested trees that have not been sprayed with the green colorant to satisfy the individual consumer.

Fertilizing

No standard procedure can be given for fertilizing growing plantations. The decision to fertilize depends upon circumstances peculiar to each individual area, including species of trees being considered and the fertility of each block. The soil should be tested by a reliable soil-testing laboratory for the standard nutrients and pH. By applying different rates of fertilizers to a few trees each year, you should be able to determine whether fertilization of your plantations would be worthwhile.

Stump Culture

Growers who operate their plantations on an all-age rotation sometimes leave a branch attached to the stump that remains after the tree has been harvested. This branch will become the main stem of a new Christmas tree. "Stumps culture" works best in spruce and fir plantations but does not fit into an even-age rotation system because this type of culture tends to establish an all-age plantation.

Harvesting

Christmas tree grades for the U.S. are outlined in the U.S. Department of Agriculture Bulletin 38 F.R. 5252 dated April 1, 1978. These published grades furnish a guide of quality for both grower and buyer and can help in settling disputes concerning the quality of certain shipments. The four grades of Christmas trees described in this bulletin are (1) U.S. Premium, (2) U.S. No. 1 or U.S. Choice, (3) U.S. No. 2 or U.S. Standard, and (4) culls. Some growers of Christmas trees have their own system of grading and do not rely upon the grades described above. Regardless of the grading system used, it should be understood by both buyer and seller.

Time of harvest depends upon the market being supplied, the species grown, rate of tree growth, and weather. Most of the trees marketed today in Illinois range from five to seven feet in height. In any one block in the plantation, trees may range from four to nine feet in height. Therefore, it

may be necessary to cut trees from this block over a three-year period to raise returns. To produce an average size (5 to 7 feet) Scotch pine, about eight years are required. White pine requires about one year longer.

Trees to be cut are tagged during early fall. Each tree to be cut should be judged for quality and readiness for market. The tags or labels may show the grower's name and address, and they may feature a brief description on care of the tree and use of approved lights on the tree. The U.S. Department of Agriculture Bulletin 38 F.R. 5252 recommends using a set tag color to indicate tree heights. At present, no uniform method is used to mark or tag Christmas trees.

Marketing

Outlets for Christmas trees come under two broad classifications, wholesale and retail. The wholesale outlet is essentially a volume operation, a simpler market arrangement with less risk and lower price. For the wholesale market, you should have a minimum of 40 acres in trees. The job of marketing for wholesale should start in early summer; firm orders and contacts should be made with buyers at this time. Retailers should have been identified during the previous Christmas season.

When selling trees wholesale, the work involved will depend on whether the trees are sold on the stump or in other ways. If trees are sold on the stump, the grower needs only to mark and grade the trees or mark the field lots to be sold. Otherwise, you might need cutting machines varying from a single handsaw to chain saws or powered rotary saws. You might also need means of hauling trees from the field to concentration and storage areas and equipment that will bale the trees (Fig. 25) and haul them long distances.

If you decide to retail your trees, you can sell them in the plantation or in a retail lot adjacent to the plantation (Fig. 26) or in a lot in a nearby town. Retail sales require a person who can meet customers well and who has two to three weeks available during the sales season. Trees sold in the plantation can be by the choose-and-cut method or by selection of trees already cut but left in the plantation. The choose-and-cut method has certain advantages such as low overhead; only those trees selected by a buyer are cut, there are no transportation costs, and the grower usually makes a larger profit per tree. Selling in the plantation, however, does require a location on an all-weather road and suitable facilities for sales during bad weather. Selling from a retail lot in town suits larger operations better than it does smaller producers. In a good location in town, a large grower would probably sell more trees than in a choose-and-cut operation. A small grower would do better with the choose-and-cut method.

Trees can be sold to organizations, such as service clubs, Boy Scouts, Girl Scouts, churches, and other organized groups. These outlets should be contacted three months or more before the Christmas season. Cost of trees to these outlets should amount to roughly half of the retail price of the tree.

A limited number of trees can be sold as living Christmas trees if you are willing to undertake additional cultural operations, such as root pruning the summer before the trees are lifted, and the trouble and expense of lifting and balling the tree.

Successful Christmas tree growers advertise on radio and television, in newspapers, on road signs, and through direct contacts. By selling only compact premium-quality trees that have been freshly cut and symmetrically shaped, growers ensure that customers will return in following years.

Figure 25. A tree-baling machine in operation. (Courtesy of *Christmas Trees.*)

Costs and Returns

Although certain fixed costs in growing Christmas trees, such as land values and annual taxes, usually cannot be changed, taxes could increase after the seedlings have been planted, depending upon the county in which the plantation is located. Variable annual costs will depend upon the individual operation. The costs will be high if you purchase expensive equipment such as tree-baling machines.

Returns from a Christmas tree venture can be divided into monetary and intangible benefits. Intangible benefits include improving wildlife habitats and conserving the soil. Most growers, however, are more interested in the monetary returns. The following tables give an estimate of the returns an average grower should expect for Scotch pine, planted at a 5- x 6-ft. spacing (1,400 trees per acre) over an eight-year period. Shearing costs are figured on a 90-percent survival rate; colorant spray and harvesting on a 70-percent rate. Marketing is by the choose-and-cut method. **Costs of land rental, site preparation, and interest on money expended are not included.**

Figure 26. A retail lot should be attractive and have adequate parking space.

Table 1. Costs for Planting Through Harvesting

Item (Pct. survival)		Cost per acre
Planting stock (100%)	1,400 trees @ $.04/tree	$56
Planting cost (100%)	1,400 trees @ $.03/tree	42
Shearing costs (yr. 3-7) (90%)	$.09/tree/year, 5 years	567
Colorant spray (70%)	$.20/tree	176
Harvesting (70%)	$.10/tree	88
Grass and weed control chemicals (yr. 1-3)		11
Mowing (yr. 1-7)	$10/acre/yr., 7 years	70
Insect & disease control	$13/acre/yr., 7 years	91
Repair & maintenance		55
Hand tools & miscellaneous		130
Land cleanup		60
Advertising		50
Total		**$1,396**

Table 2. Returns From Trees Harvested

No. of yrs. after planting	Pct. harvested (Out of 70% survived)	Income per acre
5	10% (88 trees @ $6.00 each)	$ 528
6	30% (264 trees @ $6.50 each)	1,716
7	40% (352 trees @ $7.00 each)	2,464
8	20% (176 trees @ $5.75 each)	1,012
Total		**$5,720**

If 90 percent (1,260) of the original 1,400 trees survive, and 70 percent (880) of the surviving trees become salable, production costs during the eight years would be $1,396 per acre or $1.59 per tree; income would be $5,720 per acre or $6.50 per tree. Thus your returns would be $4,320 per acre, which would give you $4.91 per tree or $540 per acre per year.

Growing Christmas trees is a business that demands good management. Keeping accurate records is especially important: they are your reference for tax purposes, and they often indicate that certain management practices need to be changed. Growers are constantly faced with sales, income, capital gains, and a host of other taxes. Advice on taxes and on both oral and written contracts can be obtained from a competent individual or firm.

Conclusion

A grower should select the proper species to match the region and site to be planted. You should prepare the site properly for planting. Good planting stock is a must; small, weak seedlings should be culled. Seedlings should be planted correctly and protected from pests, fire, and competing vegetation. Trees should be shaped well and cull trees should be kept from the market. A grower should know two or three years in advance the number and size of trees that will be for sale in any given year. You should know your market, sell your trees wisely, and keep abreast of new developments in the business.

Additional Information

There are a number of agencies and organizations that provide information that could help you solve some of your problems. Many of the more than 200 independent producers in Illinois are members of the Illinois and National Christmas Tree Growers Associations, which in their publications and at their meetings offer advice on marketing and cultural techniques. The grower can obtain aid from the county Cooperative Extension Service; the Extension Forester, University of Illinois; the State Natural History Survey; the Soil Conservation Service; and the Illinois State Division of Forestry.